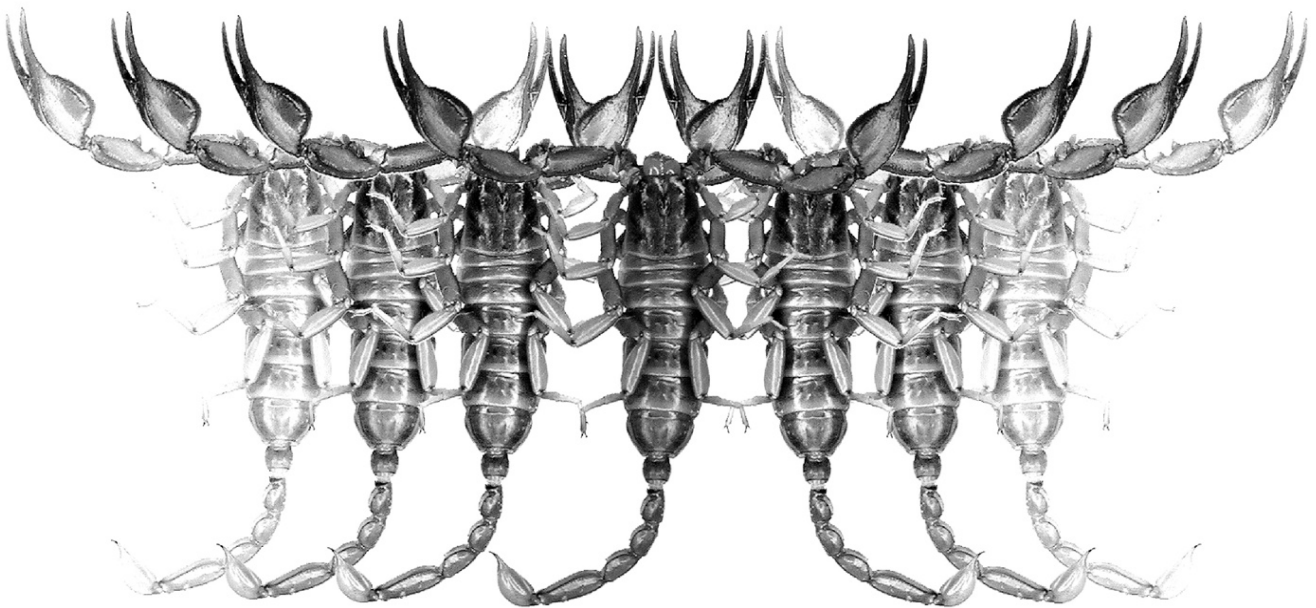


# ***Euscorpius***

**Occasional Publications in Scorpiology**



**The first troglobitic scorpions from Hispaniola,  
Greater Antilles: two new species of  
*Cazierius* Francke, 1978 (Scorpiones: Diplocentridae)**

**Rolando Teruel, Solanlly Carrero Jiménez & Gabriel de los Santos**

**November 2021 — No. 340**

# *Euscorpius*

## *Occasional Publications in Scorpiology*

EDITOR: Victor Fet, Marshall University, 'fet@marshall.edu'

ASSOCIATE EDITOR: Michael E. Soleglad, 'msoleglad@gmail.com'

TECHNICAL EDITOR: František Kovařík, 'kovarik.scorpio@gmail.com'

*Euscorpius* is the first research publication completely devoted to scorpions (Arachnida: Scorpiones). *Euscorpius* takes advantage of the rapidly evolving medium of quick online publication, at the same time maintaining high research standards for the burgeoning field of scorpion science (scorpiology). *Euscorpius* is an expedient and viable medium for the publication of serious papers in scorpiology, including (but not limited to): systematics, evolution, ecology, biogeography, and general biology of scorpions. Review papers, descriptions of new taxa, faunistic surveys, lists of museum collections, and book reviews are welcome.

### *Derivatio Nominis*

The name *Euscorpius* Thorell, 1876 refers to the most common genus of scorpions in the Mediterranean region and southern Europe (family Euscorpiidae).

*Euscorpius* is located at: <https://mds.marshall.edu/euscorpius/>

Archive of issues 1-270 see also at: <http://www.science.marshall.edu/fet/Euscorpius>

(Marshall University, Huntington, West Virginia 25755-2510, USA)

---

### ICZN COMPLIANCE OF ELECTRONIC PUBLICATIONS:

Electronic ("e-only") publications are fully compliant with ICZN ([\*International Code of Zoological Nomenclature\*](#)) (i.e. for the purposes of new names and new nomenclatural acts) when properly archived and registered. All *Euscorpius* issues starting from No. 156 (2013) are archived in two electronic archives:

- **Biotaxa**, <http://biotaxa.org/Euscorpius> (ICZN-approved and ZooBank-enabled)
- **Marshall Digital Scholar**, <http://mds.marshall.edu/euscorpius/>. (This website also archives all *Euscorpius* issues previously published on CD-ROMs.)

Between 2000 and 2013, ICZN *did not accept online texts* as "published work" (Article 9.8). At this time, *Euscorpius* was produced in two *identical* versions: online (ISSN 1536-9307) and CD-ROM (ISSN 1536-9293) (laser disk) in archive-quality, read-only format. Both versions had the identical date of publication, as well as identical page and figure numbers. *Only copies distributed on a CD-ROM* from *Euscorpius* in 2001-2012 represent published work in compliance with the ICZN, i.e. for the purposes of new names and new nomenclatural acts.

In September 2012, ICZN Article 8. What constitutes published work, has been amended and allowed for electronic publications, disallowing publication on optical discs. From January 2013, *Euscorpius* discontinued CD-ROM production; only online electronic version (ISSN 1536-9307) is published. For further details on the new ICZN amendment, see <http://www.pensoft.net/journals/zookeys/article/3944/>.

---

Publication date: 15 November 2021

<http://zoobank.org/urn:lsid:zoobank.org:pub:18E6176F-7B73-434C-8DE2-782068C222BA>

# The first troglobitic scorpions from Hispaniola, Greater Antilles: two new species of *Cazierius* Francke, 1978 (Scorpiones: Diplocentridae)

Rolando Teruel <sup>1,2</sup>, Solanlly Carrero Jiménez <sup>3</sup> & Gabriel de los Santos <sup>3</sup>

<sup>1</sup> Grupo de Sistemática y Ecología de Artrópodos Caribeños, Calle 200 # 3759, e/ 37 y 45, Reparto Versalles, La Lisa, La Habana 13500, CUBA. E-mail: [teruelrolando6@gmail.com](mailto:teruelrolando6@gmail.com)

<sup>2</sup> Instituto de Ecología y Sistemática (Subdirección de Colecciones Zoológicas), Carretera de Varona # 11835, e/ Oriente y Lindero, Reparto Calabazar, Boyeros, La Habana 11900, CUBA.

<sup>3</sup> Museo Nacional de Historia Natural „Prof. Eugenio de Jesús Marcano“. Calle César Nicolás Penson, Plaza de la Cultura Juan Pablo Duarte, Santo Domingo 10204, República Dominicana.  
E-mail: [s.carrero@mnhn.gov.do](mailto:s.carrero@mnhn.gov.do), [g.delossantos@mnhn.gov.do](mailto:g.delossantos@mnhn.gov.do)

<http://zoobank.org/urn:lsid:zoobank.org:pub:18E6176F-7B73-434C-8DE2-782068C222BA>

---

## Summary

Two new species of the Greater Antillean endemic scorpion genus *Cazierius* Francke, 1978, are herein described from the island of Hispaniola. They were found inside isolate limestone caves in the Dominican Republic and are fully troglomorphic, thus, apparently being strict troglobites that represent the first ever documented for this genus. The present additions raise the number of Hispaniolan species of both *Cazierius* and the family Diplocentridae Karsch, 1880, to five and ten, respectively.

---

## Introduction

Troglobitic scorpions are rare, but relatively widespread, both taxonomically and geographically. On one hand, about 40 such taxa have been described so far, which represents a scant 1.5% of the 2,616 nominal scorpion species acknowledged as valid to date (Rein, 2021). On the other hand, troglobites have been found in every continent and major landmasses inhabited by the order Scorpiones and include representatives of essentially all scorpion families; see a complete family, genus and literature list in Vignoli & Prendini (2009), plus relevant posterior additions in Lourenço et al. (2018), Tropea & Onnis (2020), and Karaman (2020). The majority of these troglobites are also completely or largely troglomorphic, i.e., possessing the complete array or most of the morphological characters traditionally regarded as the ultimate evidence of scorpion extreme cave adaptation: absence of eyes, appendage attenuation, depigmentation, cuticle thinning and hypertrophy of sensorial setae and telson (see e.g. Volschenk & Prendini, 2008).

Only three strictly troglobitic scorpions have been described so far from the whole Antilles, despite being a large and biogeographically complex archipelago that is also one of the best studied areas of the world, well-known for its highly diverse scorpion fauna. Two of them are non-troglomorphic members of the family Buthidae C. L. Koch, 1837: *Alayotityus delacruzii* Armas, 1973 and *Tityopsis sheylae* Teruel & Rodríguez-Cabrera, 2020, both from Cuba (Armas, 1973;

Teruel, 2001; Teruel & Kovařík, 2012; Teruel & Rodríguez-Cabrera, 2020). The third is a fully troglomorphic member of the family Diplocentridae Karsch, 1880: *Heteronebo clareae* Armas, 2001, from the tiny island of Navassa (Armas, 2001).

On September 5, 2016, while sorting undetermined arachnid specimens in the collections of the Museo Nacional de Historia Natural “Prof. Eugenio de Jesús Marcano” (Santo Domingo, Dominican Republic), the authors made an amazing discovery: a tiny, fully troglomorphic, juvenile diplocentrid scorpion, collected 15 years before in a cave at the southeastern coastal plain of Dominican Republic. However, a second surprise was on its way: on March 12, 2021, another fully troglomorphic juvenile diplocentrid scorpion was captured by the second author in a different cave, this time at a karstic hill (“mogote”) of the northeastern coast.

The detailed study and comparison of both specimens revealed that each clearly represents an undescribed species. These also imply the second and third fully troglomorphic, troglobite scorpions from the Antillean archipelago and the first from the island of Hispaniola, as well as the first troglobitic members of the endemic Greater Antillean genus *Cazierius* Francke, 1978.

## Material and methods

Specimens were studied under an AmScope SM-1T-PL LED trinocular microscope, equipped with an ocular line-scale calibrated to 20x for measuring and with an EMZ-5TRD zoom





**Figure 1.** *Cazierius cayacoa* sp. n., juvenile male holotype, habitus: **a)** dorsal; **b)** ventral. Scale bar: 1 mm.

stereomicroscope with SWF20X eyepieces. Nomenclature and measurements follow Stahnke (1971) except for trichobothriotaxy (Vachon, 1974), metasomal carinae (Francke, 1977), pedipalp chela carinae (Acosta et al., 2008, *sensu* Armas et al., 2011), and sternum (Soleglad & Fet, 2003). Because the only available specimens of both new species are juveniles, the diagnosis, description and comparisons include mostly those characters that are well-known to be ontogenetically invariable in Diplocentridae (i.e., tegumentary sculpture and carination and morphometric ratios of pedipalps and metasoma are strikingly different in immature vs. adult diplocentrids, thus, useless for diagnostic purposes), unless otherwise noted. Pectinal tooth counts were given as fractions for left/right pectines. Leg segments nomenclature and armature corresponds to Santibáñez-López et al. (2013), *sensu* Teruel (2013).

Photographs were taken with a Nikon Coolpix B500 digital camera and with a Canon EOS 7D camera using a 65 mm f/2.8 macro lens (ultraviolet light with a 365 nm UV flashlight). The images were processed with Adobe Photoshop CS5 and imageJ software, only for contrast and brightness optimization, removal of artifacts and/or unnecessary details from background and plate composition.

Localities were ordered from north to south and west to east, to make geographical orientation and map interpretation easier to the reader. The name of each locality and the administrative entities where it belongs to, adheres to the current official political-administrative division in Dominican Republic.

Specimens studied herein are all preserved in ethanol 80% and deposited in the arachnological collection of the Museo Nacional de Historia Natural “Prof. Eugenio de Jesús Marciano”, Santo Domingo, Dominican Republic (MNHNSD), and the personal collection of the first author (RTO). All labels are either handwritten or laser-printed in Spanish but were transcribed into English here for text coherence.

## Systematics

### *Cazierius cayacoa* sp. n.

(Figures 1, 3–4)

<http://zoobank.org/urn:lsid:zoobank.org:act:B1E5C590-FE37-483D-9770-B80EC2FCFA30>

**TYPE LOCALITY AND TYPE REPOSITORY.** **Dominican Republic**, *San Pedro de Macorís Province*, Ramón Santana Municipality, Monumento Natural Río Cumayasa y Cueva de las Maravillas, Cueva de las Maravillas, 18°27'06.1"N 69°09'38.6"W, 40 m a. s. l., MNHNSD.

**TYPE SPECIMENS.** **Dominican Republic**, *San Pedro de Macorís Province*, Ramón Santana Municipality, Monumento Natural Río Cumayasa y Cueva de las Maravillas, Cueva de las Maravillas 18°27'06.1"N 69°09'38.6"W, 40 m a. s. l., 14–18 October 2001, no collector specified, 1 juvenile ♂ holotype (MNHNSD 08.442).

**ADDITIONAL MATERIAL EXAMINED (not types).** Dominican Republic, San Pedro de Macorís Province, Ramón Santana Municipality, Monumento Natural Río Cumayasa y Cueva de las Maravillas, Cueva de las Maravillas (18°27'06.1"N 69°09'38.6"W), 40 m a.s.l., 18 September 2016, leg. R. Teruel, F. Schramm, 2 adult chelae (RTO).

**ETYMOLOGY.** The selected epithet is a Latinized patronym in apposition, taken straight from the name of the last Taino cacique that ruled the Higüey Chiefdom, which included the area where the type locality of this species is enclaved. Cayacoa was the second most powerful cacique of Hispaniola.

**DIAGNOSIS** (based on holotype juvenile male only). Habitus fully troglomorphic: entire animal depigmented (coloration translucent, immaculate pale whitish-yellow to beige), pedipalp, legs and metasoma conspicuously attenuated, carapace lacking median ocular tubercle and eyes (without any traces of lens and ocular pigment), trichobothria with shaft exaggeratedly long, thin and flexible, and telson with vesicle enlarged. Legs with modal formula of telotarsal spiniform setae 3/3 : 4/4 : 5/5 : 5/5. Pectines with 6/6 teeth.

**DESCRIPTION** (juvenile male holotype, total length = 9.7 mm; Fig. 1).

**Coloration.** Translucent, immaculate pale whitish-yellow to beige, only with minor dark reddish brown to blackish details (cheliceral fingertips, pedipalp finger denticles, most macrosetae and trichobothria, leg articular condyles and tips of claws and apotele, and distal half of aculeus); carapace entirely lacking ocular pigment.

**Pedipalps.** Longer and slenderer than standard for the family. Trichobothrial pattern C, orthobothriotaxic. Femur long and slender, about as wide as deep, straight in dorsal and frontal views; dorsal, internal, ventral and external surfaces slightly convex to essentially straight; all carinae obsolete to absent; tegument smooth and glossy. Patella long and slender, about as wide as deep, straight in dorsal and frontal views; dorsal, internal, ventral and external surfaces slightly convex to essentially straight; all carinae obsolete to absent; tegument smooth and glossy, internal surface shagreened. Chela long and slender, only slightly deeper than wide; manus elongate-oval and subcylindrical, distally narrower in dorsal view, moderately setose and oval in cross-section, with dorsobasal lobe round and very weak, all carinae obsolete to absent, tegument smooth and glossy; fingers long, slender, moderately curved and moderately setose, cutting edges with basal lobe/notch combination absent but moderately scalloped (inner and outer accessory denticles very large and raised), principal denticles arranged into six irregular but mostly straight rows, each flanked by very few outer supernumerary denticles (inner supernumerary denticles entirely absent).

**Carapace.** Slightly longer than wide and heptagonal. Anterior margin moderately bilobed, with 3–4 pairs of dark macrosetae (long, thin and dark) plus several minor setae (thin and pale), frontal lobes broadly paraboloid; median notch widely U-shaped, deep. Tegument smooth and glossy,

with many minor pale setae scattered all over, plus two pairs of dark macrosetae (one closely set pair on dorsosubmedian position, another widely spaced on lateromedian position). Carinae absent. Furrows: anterior median, lateral oculars, central median, posterior median, posterior marginal lateral centrals and posterior laterals wide and deep, irregularly fused altogether. Median ocular tubercle absent but indicated by the lateral ocular furrows; median and lateral eyes absent, entirely lacking lens and ocular pigment.

**Genital operculum.** Small and prominent. Halves not separated nor fused and roundly subtriangular in shape; tegument smooth and glossy. Genital papillae medium-sized, only slightly protruding and digitiform.

**Pectines.** Small (just reaching coxa-trochanter joint of leg IV), subrectangular and sparsely setose. Tooth count 6/6, teeth digitiform and slightly swollen, almost straight and basally separated; fulcra small, suboval and little bulky. Basal plate much wider than long; anterior margin widely and shallowly notched medially, posterior margin straight; tegument smooth.

**Legs.** Very long and slender for the family, with all carinae absent or indistinct; tegument smooth and glossy. Telotarsi with spiniform setal formula 3/3 : 4/4 : 5/5 : 5/5. Claws moderately long (about one-third the length of its respective telotarsus), well curved.

**Mesosoma.** Tergites almost bare, anterior and posterior margins almost straight; I–VI acarinate, VII with four inconspicuous carinae (submedian and lateral pairs very short and composed only of 2–3 aligned traces of granules); tegument smooth and glossy. Sternites densely setose (setae long and rigid, larger and denser along posterior margin), posterior margin very shallowly concave to bilobed (III–VI) or essentially straight (VII); III–VI acarinate, spiracles small and almost round; VII with traces of four inconspicuous carinae on posterior margin (submedian and lateral pairs, both extremely short, as minute lumps on posterior margin); tegument smooth and glossy.

**Metasoma.** Size standard for the family, but markedly slender, subcylindrical and sparsely setose. All carinae obsolete to absent except for the ventral transverse carinae, which is irregularly arcuate and composed of minute vestigial granules; anal arc finely and irregularly denticulate; laterodistal lobes of V inconspicuous and blunt. Intercarinal tegument smooth and glossy. Dorsal furrow complete, wide and moderately deep.

**Telson.** Densely covered with very long, dark and pale macrosetae all over except dorsally. Vesicle oval-slender but bulbous; tegument smooth and glossy, with a transverse ventrobasal row of four traces of granules and the standard four longitudinal furrows (smooth and shallow); ventral median carina absent, subaculear tubercle medium-sized, digitiform, densely setose and with very few scattered vestiges of granules dorsally. Aculeus very short, slender, sharp and weakly curved (tip broken).

**COMPARISON.** This species is very easy to distinguish from all other described congeners by its fully troglomorphic habitus. It is known from a single juvenile only, but the following two diagnostic characters are reliable by being ontogenetically invariable (i.e., never change as the animal grows and finally



matures): 1) carapace entirely lacking eyes (without any traces of lens and ocular pigment) and median ocular tubercle; 2) pedipalps, legs and metasoma conspicuously attenuate (remarkably longer and slenderer than in all other known species and their instars).

These characters are shared only by the second species described in the present paper. The distinction between them both is found below, in its Comparison section.

**DISTRIBUTION** (Fig. 3). This species is known only from the type locality and by being a troglomorphic troglobite, it is most likely a local endemic from this cave. It is located about 7 km from the seashore in the low, limestone coastal plain of southeastern Hispaniola.

**ECOLOGICAL NOTES.** There is no information in any of the labels accompanying the type specimen but from its fully troglomorphic habitus and cave occurrence, it is a presumed troglobite. In October 2016, the first author made a short visit to this cave but was allowed only to make a fast and superficial search along the well-illuminated touristic passage and even UV detection was used, no specimens were detected. Nevertheless, two decayed pedipalp chelae of different specimens were found under small rocks, in the darkest ascending chamber connected by crevices and micro-passages to the ecologically preserved, deeper section of the cave where this species most likely lives (Fig. 4b). Another, more intensive search, conducted by the second author in August 2021, did not yield any finding of this elusive species.

Cueva de las Maravillas is a big cave that was formed mostly due to water-erosion by a subterranean river born in the Cordillera Oriental, which still flows today some 20 m below the cave floor; the cave itself has eight main chambers interconnected by seven galleries and is communicated to the exterior through three entrances (Ministerio de Medio Ambiente y Recursos Naturales, 2020).

In the general karstic area outside the cave, the vegetation is mesic, broadleaf semicaducifolious forest with various degrees of human alteration (Fig. 4a). During a previous diurnal search there the first author found another diplocentrid scorpion, *Cazierius cicero* (Armas & Marcano Fondeur, 1987), together with the buthids *Centruroides altagraciae* Teruel, Armas & Kovářik, 2013 and *Microtityus consuelo* Armas & Marcano Fondeur, 1987.

**REMARKS.** The two adult chelae available are both about 6.5 mm long and their general shape is slender (as expected for a troglomorphic troglobite), but not more than in the slenderer adults of *Cazierius*, i.e., the females of *Cazierius garrido* Armas, 2004. The adult size/chela length ratio in this genus (calculated herein from preserved specimens of all known species, deposited in the first author's personal collection), ranges in absolute values from 3.40 in the most robust male of *Cazierius parvus* Armas, 1984, to 5.23 in the female holotype of *C. garrido*. Thus, by applying this ratio we extrapolate that the two adults of *C. cayacoa* sp. n. to which these chelae belonged (regardless their sex), measured not less than 22 mm and not more than 34 mm.

### *Cazierius ciguayo* sp. n.

(Figures 2–4)

<http://zoobank.org/urn:lsid:zoobank.org:act:48147D01-159C-494A-BAC4-E3674D09C438>

**TYPE LOCALITY AND TYPE REPOSITORY.** Dominican Republic, Puerto Plata Province, Sosúa Municipality, Monumento Natural Lagunas Caberete y Goleta, Cabarete, Cueva de los Murciélagos, 19°44'16"N 70°25'10"W, 47 m a. s. l., MNHNSD.

**TYPE SPECIMENS.** Dominican Republic, Puerto Plata Province, Sosúa Municipality, Monumento Natural Lagunas Caberete y Goleta, Cabarete, Cueva de los Murciélagos, 19°44'16"N 70°25'10"W, 47 m a. s. l., 12 March 2021, leg. S. Carrero, J. Almonte, 1 juvenile ♂ holotype (MNHNSD 08.582).

**ETYMOLOGY.** The selected epithet is a Latinized patronym in apposition, taken straight from the name of the native people that inhabited the general area where the type locality of this species is enclaved. The Ciguayo people were an ancient native lineage of uncertain origin (maybe Central American), who even had a language very different from Taino and all other Arawak-family languages spoken all over the insular Caribbean.

**DIAGNOSIS** (based on holotype juvenile male only). Habitus fully troglomorphic: entire animal depigmented (coloration translucent, immaculate pale whitish-yellow to beige), pedipalp, legs and metasoma conspicuously attenuated, carapace lacking median ocular tubercle and eyes (without any traces of lens and ocular pigment), trichobothria with shaft exaggeratedly long, thin and flexible, and telson with vesicle enlarged. Legs with modal formula of telotarsal spiniform setae 3/3 : 4/4 : 4/4 : 4/4. Pectines with 6/6 teeth.

**DESCRIPTION** (juvenile male holotype, total length = 15.6 mm; Fig. 2). **Coloration.** Translucent, immaculate beige to very pale whitish-yellow, only with minor dark reddish brown to blackish details (cheliceral fingertips, pedipalp finger denticles, most macrosetae and trichobothria, leg articular condyles and tips of claws and apotele, and distal half of aculeus); carapace entirely lacking ocular pigment.

**Pedipalps.** Longer and slenderer than standard for the family. Trichobothrial pattern C, orthobothriotaxic. Femur long and slender, about as wide as deep, straight in dorsal view and feebly curved in frontal view; dorsal surface slightly convex, internal and external surfaces essentially straight, ventral surface slightly concave; all carinae obsolete to vestigial, the dorso-exterior, dorso-interior and ventro-interior with only a few widely spaced small granules on basal third; tegument smooth and glossy, with a few small granules scattered on dorsal surface only. Patella long and slender, slightly wider than deep, straight in dorsal and frontal views; dorsal, internal, ventral and external surfaces slightly convex to essentially straight; all carinae absent to obsolete except the dorso-interior, which is weakly granulose to subcrenulate; tegument



**Figure 2.** *Cazierius ciguayo* sp. n., juvenile male holotype, habitus: a) dorsal; b) ventral. Scale bar: 1 mm.

smooth and glossy, internal surface minutely and densely granulose. Chela long and slender, deeper than wide, with a medium-sized distal depression bordered by dark granules on internal surface near the base of fixed finger; manus elongate-oval and moderately compressed, distally narrower in dorsal view, moderately setose and oval in cross-section, with dorsobasal lobe round and not too prominent, all carinae obsolete to vestigial, tegument smooth and glossy; fingers very long, slender, shallowly curved and moderately setose, cutting edges with basal lobe/notch combination absent but moderately scalloped (inner and outer accessory denticles very large and raised), principal denticles arranged into six irregular but mostly straight rows, each flanked by very few outer supernumerary denticles (inner supernumerary denticles entirely absent).

**Carapace.** Markedly longer than wide and heptagonal. Anterior margin strongly bilobed, with four pairs of macrosetae (long, thin and dark) plus many minor setae (rigid, thin and pale), frontal lobes narrowly paraboloid; median notch widely U-shaped, deep. Tegument smooth and glossy, with many

minor pale setae scattered all over, plus two pairs of long dark macrosetae (one closely set pair on dorsosubmedian position, another widely spaced on lateromedian position). Carinae absent. Furrows: anterior median, lateral oculars, central median, posterior median, posterior marginal lateral centrals and posterior laterals narrow and shallow, irregularly fused altogether. Median ocular tubercle absent, but indicated by the lateral ocular furrows; median and lateral eyes absent, entirely lacking lens and ocular pigment.

**Genital operculum.** Small and prominent. Halves not separated nor fused and roundly subtriangular in shape; tegument smooth and glossy. Genital papillae medium-sized, only slightly protruding and digitiform.

**Pectines.** Small (just reaching coxa-trochanter joint of leg IV), subrectangular and sparsely setose. Tooth count 6/6, teeth digitiform and slightly swollen, almost straight and basally separated; fulcra very small, subtriangular and little bulky. Basal plate much wider than long; anterior margin widely and shallowly notched medially, posterior margin straight; tegument smooth.

**Legs.** Very long and slender for the family, with all carinae absent or indistinct; tegument smooth and glossy. Telotarsi with spiniform setal formula 3/3 : 4/4 : 4/4 : 4/4. Claws moderately long (about one-third the length of its respective telotarsus), well curved.

**Mesosoma.** Tergites almost bare, anterior and posterior margins almost straight; I–VI acarinate, with tegument smooth and glossy; VII with four inconspicuous carinae (submedian pair very short and composed only of 2–3 aligned granules, lateral pair long, straight and very weakly and finely granulose) and tegument minutely and densely granulose. Sternites sparsely setose (denser on VI–VII), posterior margin very shallowly concave to bilobed (III–VI) or essentially straight (VII); III–VI acarinate, with tegument smooth and glossy, spiracles small and short-oval to round; VII with traces of four inconspicuous carinae on posterior margin (submedian and lateral pairs, both very short, parallel and smooth), with tegument coriaceous.

**Metasoma.** Size standard for the family, but markedly slender, subcylindrical and moderately setose. All carinae vestigial to weak and subgranulose to subcrenulate, the single exception is the ventral transverse carinae, which is irregularly arcuate and composed of medium-sized conical denticles; anal arc finely and irregularly denticulate; laterodistal lobes of V inconspicuous and blunt. Intercarinal tegument smooth and glossy, with minute to small granules irregularly scattered all over, denser on V. Dorsal furrow complete, wide and shallow.

**Telson.** Densely covered with very long, dark and pale macrosetae all over except dorsally. Vesicle oval-slender but bulbous; tegument smooth and glossy, with minute granules irregularly scattered dorsally plus a transverse ventrobasal row of eight conical denticles and the standard four longitudinal furrows (smooth and shallow); ventral median carina absent, subaculear tubercle medium-sized, digitiform, densely setose and with few scattered small granules, mostly dorsally. Aculeus very short, slender, sharp and weakly curved.

**COMPARISON.** As discussed above for *C. cayacoa* sp. n., *C. ciguayo* sp. n. can be very easily distinguished from all other previously described congeners by their fully troglomorphic habitus, both sharing the complete lack of eyes and median ocular tubercle, as well as the conspicuous attenuation of the pedipalps, legs and metasoma.

Despite both species are known only by a single juvenile each, one ontogenetically invariable character is clearly diagnostic between both taxa: the modal formula of telotarsal spiniform setae, which is 3/3 : 4/4 : 4/4 : 4/4 in *C. ciguayo* sp. n., vs. 3/3 : 4/4 : 5/5 : 5/5 in *C. cayacoa* sp. n.

Moreover, although both specimens appear to represent different immature instars, both are males and this warrants a reliable comparison based on other secondary characters: **1)** the intercarinal sculpture of tergite VII (minutely granulose in *C. ciguayo* sp. n., vs. smooth in *C. cayacoa* sp. n.); **2)** the intercarinal sculpture of sternite VII (coriaceous in *C. ciguayo* sp. n., vs. smooth in *C. cayacoa* sp. n.); **3)** the setation of sternites (much stronger and denser in *C. cayacoa* sp. n.); **4)**

the carination of metasoma (markedly stronger in *C. ciguayo* sp. n.); **5)** the intercarinal sculpture of metasoma (sparsely granulose in *C. ciguayo* sp. n., vs. smooth in *C. cayacoa* sp. n.). Nevertheless, all these characters are ontogenetically variable and thus, their state in adults is expected to differ from above. Therefore, none was included in the diagnosis of each species.

Last, the caves where both scorpions were collected are widely disjunct and belong to unrelated, independent subterranean systems. Hence, the possibility of a same troglomorphic species occurring on both is unlikely.

**DISTRIBUTION** (Fig. 3). This species is known only from the type locality and by being a troglomorphic troglobite, it is most likely a local endemic from this cave or the subterranean system where it belongs. It is located about 1.5 km from the seashore in a small, low, karstic limestone coastal hilly formation (= mogotes) of northern Hispaniola.

**ECOLOGICAL NOTES.** The type specimen was collected from a shallow scrape under a rock, which was semi-buried in the mixed clay/bat guano soil of the dark zone of the cave, 20 m deep from the entrance (Fig. 4d). From its fully troglomorphic habitus and cave occurrence, it is a presumed troglobite.

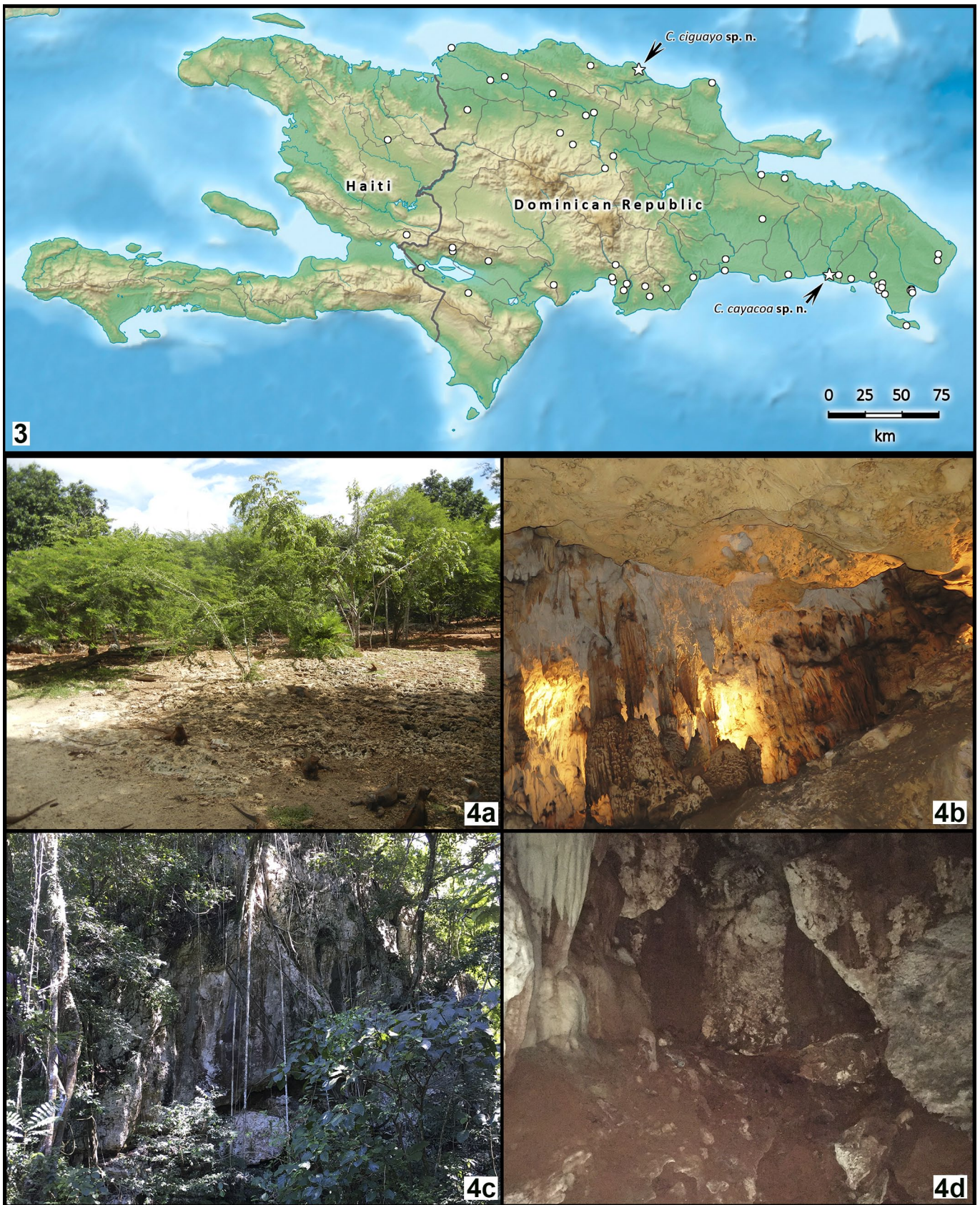
Cueva de los Murciélagos is a big cave and at the far end there is a pool of crystal clear water that leads to Cueva de La Escalera. These two caves comprise the Sistema La Escalera, the third largest underwater cave in Dominican Republic, about 1 km long and 25 meters deep. They are connected together through a huge dry cave with no outside access (DRSS, 2020).

In the general karstic area outside the cave, the vegetation is mesic, broadleaf semicaducifolious forest with various degrees of human alteration (Fig. 4c). During a previous diurnal search there, the first author found another diplocentrid scorpion: *Cazierius* sp. aff. *cicero* (Armas & Marciano Fondeur, 1987). Another scorpion recorded from the same forest is the buthid *Tityus* sp. aff. *ottenwalderi* Armas, 1999, by Teruel & Santos (2018: fig. 10).

## General remarks

The generic placement of the two new species described herein has been established tentatively. All characters currently acknowledged as diagnostic for *Cazierius* are clearly present in both specimens and those that are different match what could be hypothesized for a fully troglomorphic, troglobite member of this genus. Moreover, in Hispaniola this is the only genus so far known to occur in the Northern Paleo-island (where it is widespread), while *Heteronebo* Pocock, 1899 is restricted to the Southern Paleo-island (Santos et al., 2016: 15; figs. 3g–h). Nevertheless, the taxonomic characters of Diplocentridae are best evaluated in adults, because deep ontogenetic variation occurs in many genera/species and may lead to misidentifications; thus, once the adults of both *C. ciguayo* sp. n. and *C. cayacoa* sp. n. become available, such generic placement must be revised.





**Figures 3–4.** **Figure 3.** Updated geographical distribution of the genus *Cazierius* in Hispaniola: trogllobitic species (stars) and epigeic species (circles). Records include the complete literature published on the genus, plus unpublished data of the first author. **Figure 4.** Habitat and microhabitat of the trogllobitic species of *Cazierius* described in the present paper: **a–b)** *C. cayacoa* sp. n., surroundings of Cueva de las Maravillas (a) and interior of the cave (b); **c–d)** *C. ciguayo* sp. n., surroundings of Cueva de los Murciélagos (c) and interior of the cave (d).



The two species described in the present paper are the first troglomorphic scorpions described from Hispaniola. Several vast areas of this island are limestone karstic and have extensive underground systems, e.g., the Tiburón Peninsula, Sierra de Bahoruco, the coastal plain from Pedernales to Oviedo, the San Cristóbal southern foothills of the Cordillera Central, the coastal plain from San Pedro de Macorís to Bávaro, Los Haitises, the Samaná Peninsula, and the coastal hills from Nagua to Puerto Plata. Hundreds of caves there remain largely unexplored for arachnological purposes, thus, additional discoveries of troglobites there may be expected.

## Acknowledgements

We greatly thank Juan Almonte for his continuous and enthusiastic help to the second author during many speleological explorations, including the one that yielded the Cabarete specimen described herein. Also, to Sheyla Yong (Havana, Cuba), for the assistance during desk work and the critical review of an earlier draft of the manuscript. The latter process was also accomplished by two anonymous referees, to whom we are also grateful.

## References

- ACOSTA, L. E., D. M. CANDIDO, E. H. BUCKUP & A. D. BRESCOVIT. 2008. Description of *Zabius gaucho* (Scorpiones, Buthidae), a new species from southern Brazil, with an update about the generic diagnosis. *The Journal of Arachnology*, 36: 491–501.
- ARMAS, L. F. DE. 1973. Escorpiones del archipiélago cubano. I. Nuevo género y nuevas especies de Buthidae (Arachnida: Scorpionida). *Poeyana*, 114: 1–28.
- ARMAS, L. F. DE. 2001. Scorpions of the Greater Antilles, with description of a new troglobitic species (Scorpiones: Diplocentridae). Pp. 245–253 in: Fet, V. & P. A. Selden (eds.). *Scorpions 2001. In memoriam Gary A. Polis*. Burnham Beeches, Bucks: British Arachnological Society, xi + 404 pp.
- ARMAS, L. F. DE, R. TERUEL & F. KOVAŘÍK. 2011. Redescription of *Centruroides granosus* (Thorell, 1876) and identity of *Centruroides granosus simplex* Thorell, 1876 (Scorpiones: Buthidae). *Euscorpius*, 127: 1–11.
- DOMINICAN REPUBLIC SPELEOLOGICAL SOCIETY [DRSS]. 2021. *Sistema La Escalera*. Available at: <https://www.dr-ss.com/sistema-la-escalera> [Accessed on October 2, 2021].
- FRANCKE, O. F. 1977. Scorpions of the genus *Diplocentrus* Peters from Oaxaca, Mexico. *The Journal of Arachnology*, 4: 145–200.
- KARAMAN, I. 2020. A new *Euscorpius* species (Scorpiones: Euscorpiidae) from a Dinaric cave — the first record of troglobite scorpion in European fauna. *Biologia Serbica*, 42: 14–31.
- LOURENÇO, W. R., D.-S. PHAM, T.-H. TRAN & T.-H. TRAN. 2018. The genus *Vietbocap* Lourenço & Pham, 2010 in the Thien Duong cave, Vietnam: a possible case of subterranean speciation in scorpions (Scorpiones: Pseudochactidae). *Comptes Rendus Biologies*, 341: 264–273.
- MINISTERIO DE MEDIO AMBIENTE Y RECURSOS NATURALES. 2020. *La biodiversidad en la República Dominicana. Proyecto Aumento de la capacidad de adaptación ecosistémica en las Reservas de la Biosfera fronterizas en la República de Haití y la República Dominicana*. Cooperación Alemana, GIZ, Santo Domingo, 606 pp.
- REIN, J. O. 2021. *The Scorpion Files*. Available at: <http://www.ntnu.no/ub/scorpion-files/> [Accessed on October 2, 2021].
- SANTIBÁÑEZ-LÓPEZ, C. E., O. F. FRANCKE & L. PRENDINI. 2013. Systematics of the *keyserlingii* group of *Diplocentrus* Peters, 1861 (Scorpiones: Diplocentridae), with descriptions of three new species from Oaxaca, Mexico. *American Museum Novitates*, 3777: 1–47.
- SANTOS, G. DE LOS, L. F. DE ARMAS & R. TERUEL. 2016. Lista anotada de los escorpiones (Arachnida: Scorpiones) de La Española (República Dominicana y Haití). *Novitates Caribaeae*, 10: 1–22.
- SOLEGLAD, M. E. & V. FET. 2003. The scorpion sternum: structure and phylogeny (Scorpiones: Orthosterni). *Euscorpius*, 5: 1–34.
- STAHNKE, H. L. 1971. Scorpion nomenclature and mensuration. *Entomological News*, 81: 297–316.
- TERUEL, R. 2001. Redescipción de *Alayotityus delacruz* Armas, 1973 (Scorpiones: Buthidae). *Revista Ibérica de Aracnología*, 3: 17–24.
- TERUEL, R. 2013. La subfamilia Diplocentrinae (Scorpiones: Scorpionidae) en Cuba. Sexta parte: nueva especie de *Cazierius* Francke 1978. *Revista Ibérica de Aracnología*, 23: 43–48.
- TERUEL, R. & F. KOVAŘÍK. 2012. *Scorpions of Cuba*. Prague: Clairon Productions, 231 pp.
- TERUEL, R. & T. M. RODRÍGUEZ-CABRERA. 2020. Revision of the genus *Tityopsis* Armas, 1974 (Scorpiones: Buthidae). Part 1. General updates and description of four new species. *Euscorpius*, 304: 1–40.

- TERUEL, R. & G. DE LOS SANTOS. 2018. Two new *Tityus* C. L. Koch, 1836 (Scorpiones: Buthidae) from Hispaniola, Greater Antilles. *Euscorpius*, 257: 1–16.
- TROPEA, G. & C. ONNIS. 2020. A remarkable discovery of a new scorpion genus and species from Sardinia (Scorpiones: Chactoidea: Belisariidae). *Arachnida, Rivista Aracnologica Italiana*, 6(26): 3–25.
- VACHON, M. 1974. Études des caractères utilisés pour classer les familles et les genres des scorpions (Arachnides). 1. La trichobothriotaxie en arachnologie. Sigles trichobothriaux et types de trichobothriotaxie chez les Scorpions. *Bulletin du Muséum national d'Histoire naturelle*, 3e série, 140 (Zoologie, 104): 857–958.
- VIGNOLI, V. & L. PRENDINI. 2009. Systematic revision of the troglomorphic North American scorpion family Typhlochactidae (Scorpiones: Chactoidea). *Bulletin of the American Museum of Natural History*, 326: 1–94.
- VOSCHENK, E. S. & L. PRENDINI. 2008. *Aops oncodactylus*, gen. et sp. nov., the first troglobitic urodacid (Urodacidae: Scorpiones), with a re-assessment of cavernicolous, troglobitic and troglomorphic scorpions. *Invertebrate Systematics*, 22: 235–257.